# LAWRENCE LIVERMORE REPORT

A weekly collection of scientific and technological achievements from Lawrence Livermore National Laboratory: Sept. 8-15, 2008.

## Lab scientists contribute to Large Hadron Collider experiments

**Lab physicist David Lange, dwarfed by the 20,000-ton Compact Muon Solenoid (CMS) detector at the Large Hadron Collider, the world's most powerful accelerator**

In the start of an experiment physicists believe will help resolve basic questions about the nature of the universe, the first proton beam was circulated last Wednesday through the 17-mile-long Large Hadron Collider, the world's most powerful particle accelerator.

Located at the CERN particle physics research center near Geneva, Switzerland, the Large Hadron Collider (LHC) is a multi-national

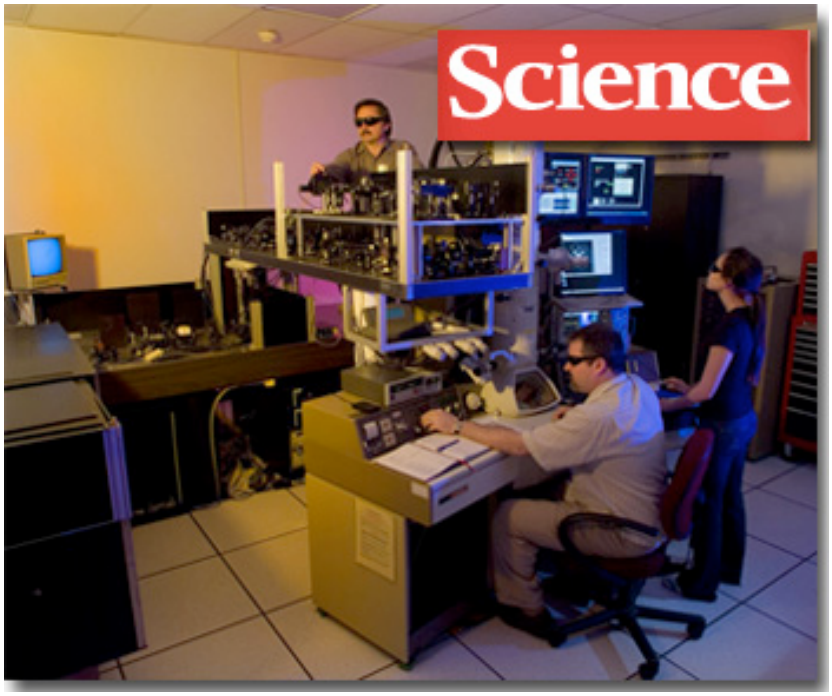
project supported by the U.S. Department of Energy's Office of Science and the National Science Foundation and other institutions, including the Laboratory.

"The Large Hadron Collider opens up a new era in physics and we are excited to be among the collaborators contributing to LHC detector technology and experiments," said Doug Wright, LLNL High Energy Physics Group leader. "This facility will remain at the center of international research efforts in physics for the foreseeable future and will no doubt give us a completely new understanding of our universe."

Lab scientists are collaborators on the Compact Muon Solenoid (CMS) experiment, a 20,000-ton apparatus designed and constructed over 15 years in concert with the LHC accelerator. The CMS detector is searching for the elusive Higgs particle and "supersymmetry" from proton collisions. In addition to Wright, contributors include career Lab physicists David Lange and Jeff Gronberg, and postdocs Jonathan Hollar and Bryan Dahmes, currently stationed at CERN.

For more, see *Newsline:* https://newsline.llnl.gov/_rev02/index.php

**Taking a look at the transformation of nanoscale structures**




**Left to right, Curtis Brown, Thomas LaGrange and Judy Kim make adjustments to the dynamic transmission electron microscope.**

Researchers have achieved a milestone in materials science and electron microscopy by taking a high-resolution snapshot of the transformation of nanoscale structures.

Using the Lab's Dynamic Transmission Electron Microscope (DTEM), Judy Kim and colleagues peered into the microstructure and properties of reactive multilayer foils (also known as nanolaminates) with 15-nanosecond-scale resolution.

"This is the first time that a detailed study of these reactive nanolaminates has exposed what is happening in the self-propagating high-temperature synthesis zone," Kim said.

Observing short-lived behavior -- how a chemical reaction, structural deformation or phase transformation occurs -- is not easy, but is key to understanding many of the basic phenomena at the heart of chemistry, biology and materials science. The ability to directly observe and characterize these complex events leads to a fundamental understanding of properties such as reactivity, stability and strength, and helps in the design of new and improved materials and devices.

That's where Livermore's DTEM comes in. It provides scientists with the ability to image transient behavior with an unprecedented

combination of spatial and temporal resolution: nanometers and nanoseconds.

See press release at https://publicaffairs.llnl.gov/news/news_releases/2008/NR-08-09-02.html or *Science* at

http://www.sciencemag.org/cgi/content/abstract/321/5895/1472

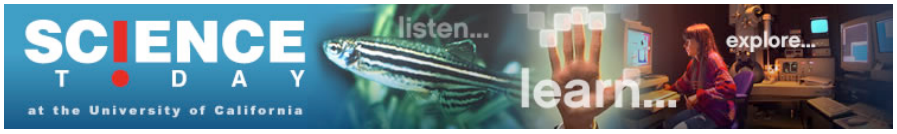
**Building better detectors**

Newsweek

What do bananas, smoke alarms, toilets and large granite buildings have in common? Like many objects, they're sufficiently radioactive to set off radiation detectors. Efforts since 9/11 to prevent the detonation of a dirty bomb -- an explosive device designed to spread harmful or lethal radiation, as well as panic -- are plagued by the risk of false alarms, known as false positives.

*Newsweek* looks at what scientists, including those from Lawrence Livermore National Laboratory, are doing to help distinguish dirty bombs from bananas and other benign radioactive sources. See the article at http://www.newsweek.com/id/154987

**CBS radio highlights Lab research in water clean-up, infections in blood**



"Science Today," the CBS-syndicated radio show on breakthroughs in science and technology, recently looked at two Laboratory areas of research, water cleanup and detecting infections in blood.

For more details see:
Researchers Investigate New Ways to Clean Up Water at
http://www.ucop.edu/sciencetoday/article/18512

Technology to Detect Bloodstream Infections More Quickly at
http://www.ucop.edu/sciencetoday/article/18472

**New *Science & Technology Review* now available**

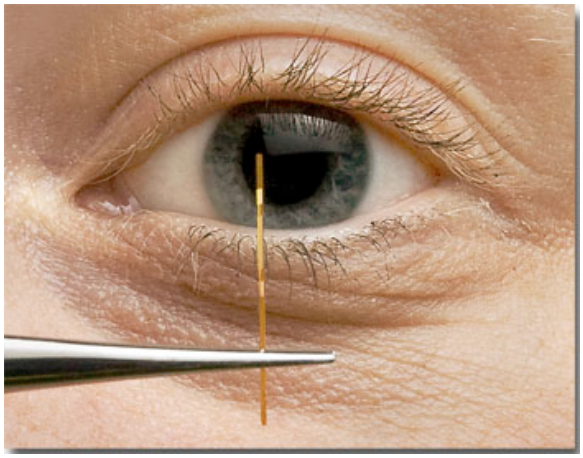

The September/October 2008 edition of the Lab's *Science* & *Technology Review,* with in-depth articles about Livermore research projects is available online. Feature articles include: high-resolution simulations of Type 1a supernovae; developing new drugs and personalized medical treatment; and a skin patch that can quickly detect exposure to biological pathogens.

See *S&TR* at https://www.llnl.gov/str/

**Latest editon of weekly *Newsline* available**

*Newsline* provides the latest lab research and operations news.
See the latest issue at https://newsline.llnl.gov/_rev02/index.php

**Photo of the week**



Keeping an eye on radioactivity -- Julie Herberg holds a radio frequency lithographically produced microcoil used in the Laboratory's portable nuclear magnetic resonance (NMR) experiments. Miniaturizing the parts enabled the size of the NMR to be reduced from a large copymachine-sized unit to a small briefcase-sized portable device.

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LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

To send input to the Livermore Lab Report, send e-mail mailto:labreport@llnl.gov.

The Livermore Lab Report archive is available at: https://publicaffairs.llnl.gov/news/lab_report/2008index.html